

Servicing Standard-Triumph water pumps

This document sets out what I did to refurbish some Triumph water pumps in my possession. The method set out here is applicable to many automotive water pumps. Talking with Muzz Inwood, a club member, he said that he had to supply several water pump bodies to a repairer before a body suitable for refurbishment was found. This for a Humber Super Snipe, which appears to use the same style of, if not the same, seal as the Standard-Triumph engines, with presumably similar limits on allowable depth of the sealing face within the body casting.

Standard-Triumph used essentially the same water pump in most, if not all, post-war production cars fitted with pushrod type engines. In early production cars, the pump was designed to be repaired and the component parts were separately listed by Standard-Triumph. (Refer diagram on next page.) There were few variations in the pump itself. The drive pulley was a separate item and varied between different models and dates. Earlier cars (Phase I Vanguard/Triumph Renown) use a cotter pin to lock the pulley to the pump spindle. Later cars used a Woodruff key. Latest/current production water pump/pulley combinations are simply pressed together, relying on an interference-fit between the separate components to hold them in place.

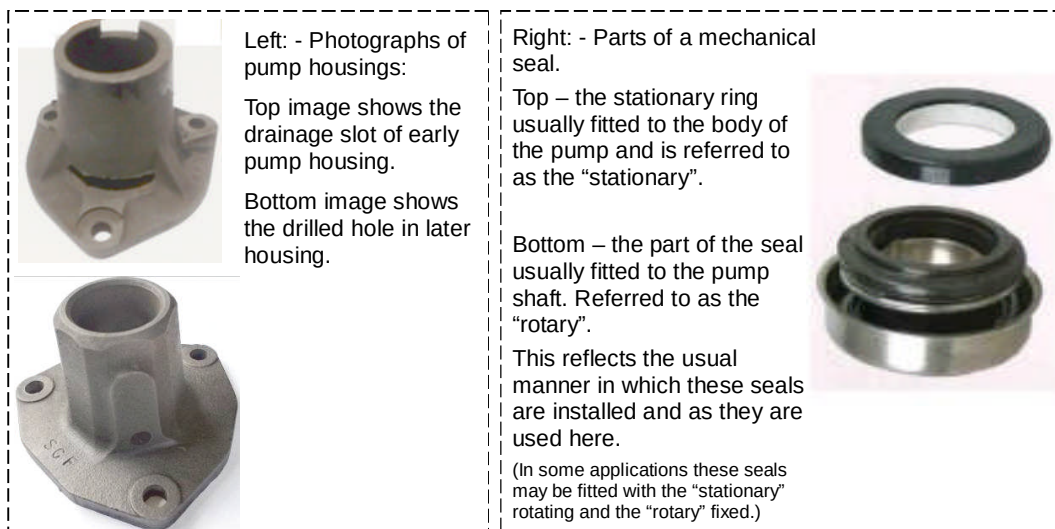
The following pages describe the repair of those Triumph pumps, those with 16mm spindles and using locally sourced components as far as possible. Some early pumps have a 5/8" spindle in which case most of what is written here still applies but suitable replacement bearings would need to be identified.

A hydraulic press is highly desirable when servicing these pumps. If modifying a pump, as set out here, access to metal-working machinery is required.

When working with mechanical seals, cleanliness is essential. The seal faces must be protected against foreign material such as dust and grit. Use a soft, lint-free cloth to clean the faces if required.

Note: Part No. 60313 (#27 in "Fig. 10" next page) is described in parts listings as a "seal" but in service manuals is described as a "spinner". It is simply a disc that sits on the spindle – held in place by friction – that intercepts any water heading toward the bearings and flings it away from the spindle to the interior of the housing where it then flows out the drainage slot/hole. One could easily be made if necessary.

Also note that there are some "aftermarket" pumps out there that differ in some internal dimensions.



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Early production water pumps:

The diagram below shows the configuration of these pumps. Apart from some very early pumps and for current offerings, the impellor is made of brass (part # 104840). The following text and images are taken from the "Triumph Herald 1200, 1250, Vitesse and Spitfire" factory workshop manual. Parts referred to in this document are highlighted in the table below.

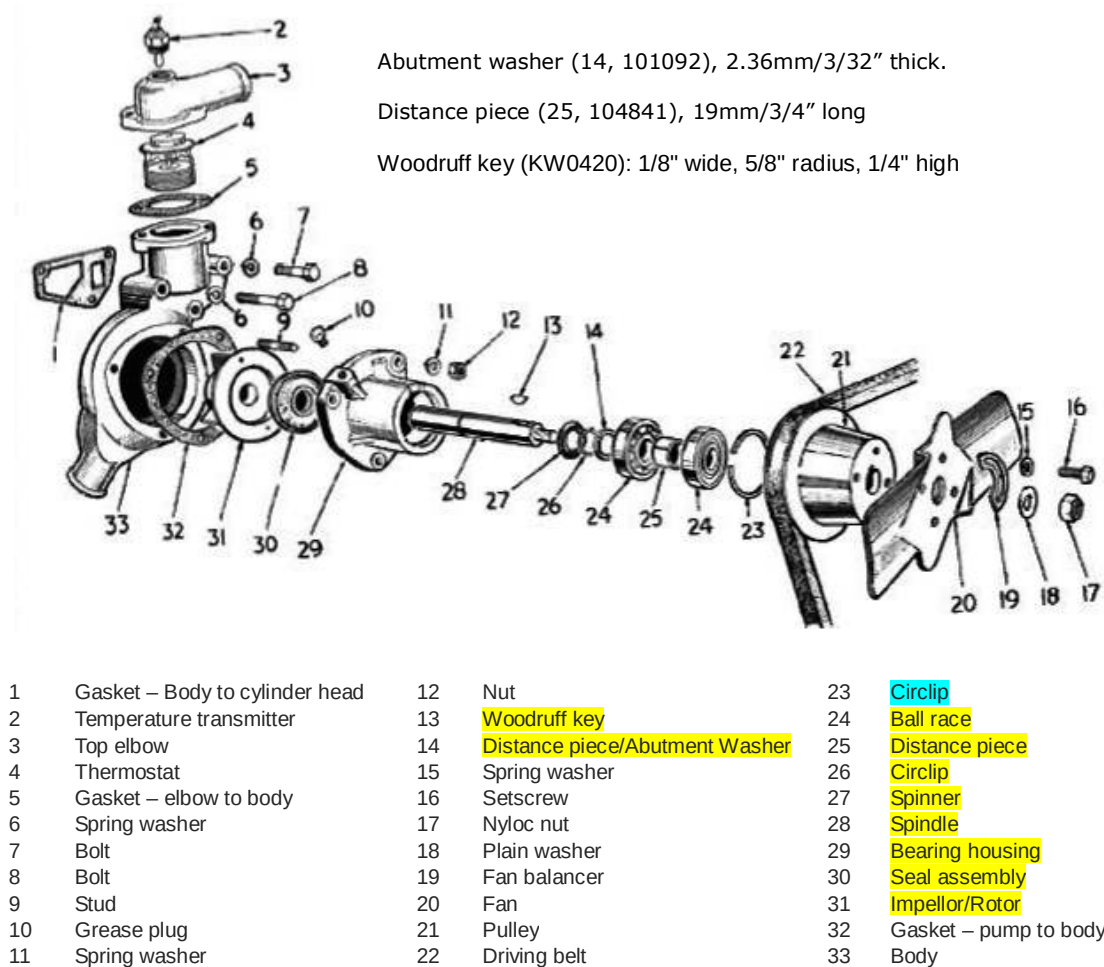


Fig. 10: Exploded water pump assembly (Herald 1200, 12/50)
Spitfire has four fan blades and Vitesse has items 15 – 20 deleted.

WATER PUMP SERVICE PROCEDURE:

BEARING HOUSING ASSEMBLY (FIG 10)

To Dismantle

1. Remove items (17) and (18) and detach the pulley (21).
2. Use Churchill Tool No, FTS.127 with Press S.4221A to remove the impellor (31) and seal assembly (30). (See Fig. 11.)
3. Remove the circlip (23) and drift out shaft and ball race assembly.
4. Remove the spinner (27), circlip (26), washer (14) and Woodruff key (13) from the shaft (28) and press off items (24) and (25).

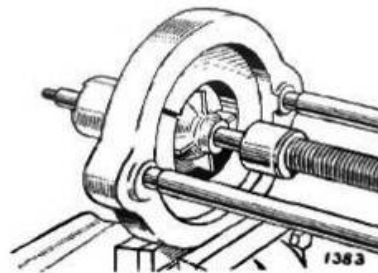


Fig. 11. Removing impeller from pump spindle

Re-cutting the Sealing Gland Face (Fig. 12).

Use Churchill Tool No. S.126 as follows:-

1. Insert the pilot end of the tool from the gland side of the housing.
2. Fit the bush (small diameter leading), tool bearing and knurled nut on the protruding pilot.
3. Turn the knurled nut to bring the cutters into contact with the seal face. Rotate the tommy bar and simultaneously tighten the knurled nut to maintain a light cut until the gland face is free from score lines. Periodically remove and clean the tool whilst carrying out the cutting operation.

The depth of the gland face from the housing mounting face must not exceed 0.265" (6.7mm).

Re-assembly (Fig. 13)

1. Fit items (27), (26) and (14) to the shaft (28). Pack the ball races (24) with grease and press onto the shaft with their sealed faces outwards and the spacer (25) between them.
2. Using a tubular drift, drive the bearings with the shaft (28) into the housing and secure with the circlip (23). Press the seal assembly (30) into the impellor (31).
3. Using a 0.030" (0.762mm) thick spacer, press the impellor (31) onto the shaft (28) as shown on Fig. 13. Solder the impellor to the end of the shaft to prevent leakage.
4. Fit the Woodruff key (13) and pulley (21) to the shaft (28), securing with a nyloc nut (17) and plain washer (18).

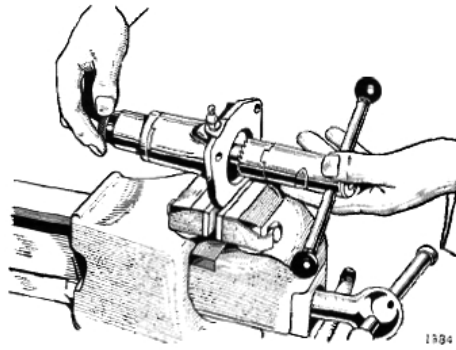


Fig. 12. Re-cutting sealing gland face

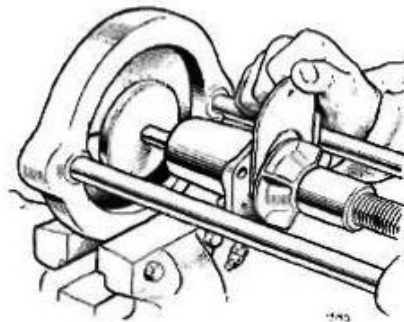


Fig. 13. Using gauge to obtain 0.030" (0.762 mm.) clearance between impellor and housing face

TO SERVICE A PUMP WITHOUT SPECIAL TOOLS:

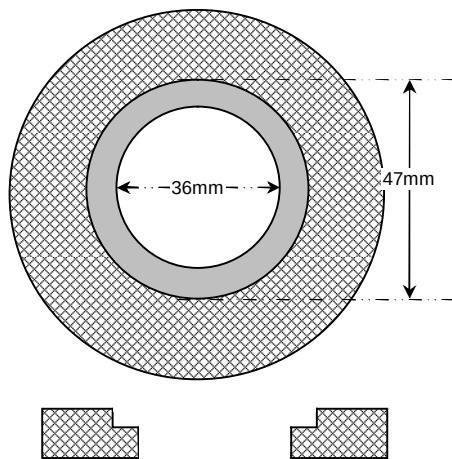
Once the pump has been removed to the bench then undo the nut holding the pulley in place and remove the pulley. (Remove cotter pin on very early pumps.) This is not usually hard to do – leaving the nut on the end of the spindle and gently tapping it with a hammer while holding the pulley is usually enough to do the job. If it cannot be removed easily, use a gear puller or a press to separate them. A bit of penetrating oil and/or heat may help if it is particularly stubborn. Remove the bearing retaining circlip and the Woodruff key.

The impellor is a press fit on the spindle. There may be solder between the spindle and the impellor. The solder is not there to hold the impellor in place – the press-fit does that – but to ensure a water-proof seal between the impellor and spindle. Unless a previous service person has been over enthusiastic then any solder can be ignored and the spindle may simply be pressed through the impellor. If the impellor doesn't move readily, a bit of heat will help.

Sit the housing in the press and ensure that it is well supported on its nose, with clearance for the bearings and spindle. Press out the spindle. (See drawing next page for an easily made support plate.) The spindle is 16mm in diameter so a piece of 1/2" or 5/8" rod may be used. (An old socket of appropriate size can be useful here.)

Removing the spindle from the impellor will also partly eject the bearings. Ensure that there is clearance between the supporting plates to permit this. Once the impellor has been separated from the spindle, dismantle the remaining assemblies. Normally bearings will be readily removed without tools but if tight, use a hammer and brass drift. Remove the bearings, spacer, abutment washer, 60313 seal and circlip from the spindle and give everything a good clean.

The sketch below shows a simple tool made to support the pump housing while removing the impellor. It's not essential but does make the job easier.



Plan and cross-section for support plate for housing. This works for all the Triumph pumps I have but an aftermarket pump has a larger (48mm) diameter nose.



Finished housing support plate.

THE BEARINGS:

Hoffmann N2897 bearings (Triumph part # 100764) used in these pumps are now obsolete and hard to find. A bearing that may be substituted and is readily available is the **6202-16-2RS** which has a 16mm bore (The "normal" 6202 is 15mm). It is only 11mm wide where the N2897 bearing is 12.9mm wide. The faces of the hub of the 6202-16 bearing assembly are flush with those of the outer race whereas for the N2897 bearings the open side hub face sits 0.4mm below that of the outer race. The effect of this is that the assembled spindle and bearings are 0.8mm too long for the housing. This is readily fixed by removing 0.8mm from the distance piece. With the original bearings and spindle (re-)assembled, measure the inside distance between the outer races. This will give you the required length of the distance piece with the 6202-16 bearings.

When using the 6202-16 bearings, a spacer 1.6 - 2mm thick should be fitted beneath the pulley. A thicker abutment washer - 4.25mm (use 4mm) thick could be used but is not essential.



At left, a N2897 ball bearing removed from a Triumph water pump. Upper picture shows the closed side of the bearing. Lower picture shows the open side which sits against the distance piece between the bearings.

At right is a 6202-16-2RS used to rebuild a pump.

Significant differences between them are noted in the above text.



At the time of writing, 6202-16-2RS bearings are readily available from several suppliers; e.g. NZ Miniature Bearings and Bearing and Engineering Supplies to name but two.

In the following table, bearings in the middle column have been found in Triumph water pumps:

MANUFACTURER	PART No.	Equivalent PART Nos
Hoffmann	N2897	N4768A (RHP) 87016 (Generic)
F.B.C.	61202F	
SKF	BG - 8016	

THE SEAL:

The original seal (148322) is still available, though I would be reluctant to use it. The main issue here is that the housing itself forms one of the faces of the seal and a failed seal is most likely reason the pump needs repair. Using the original style seal solves only half the problem - the mating face of the housing would need to be machined flat and very smooth.

THE SEAL ACTS BETWEEN THE IMPELLOR AND HOUSING – IT DOES NOT SEAL AGAINST THE SPINDLE.

Photograph at right shows the bearing housing taken from a Herald car. The green shaded area shows where the carbon face of the rotating part of the seal contacts (seals against) the housing. In this case, there is substantial wear in this area and resurfacing would exceed the reconditioning limits.

Officially this housing would then be scrap despite the fact that is otherwise in very good condition, due to the seal face depth being at the maximum allowed value.

The lower photograph is a close-up view of the sealing surface of this housing. It is quite rough and worn. A sharp wear ridge about 0.010" high is present in the area denoted by a brown dotted circle.

Requirements of a replacement seal:

Given that it may be desired to re-use the original spindle, providing a seal against the spindle itself is not feasible. Sealing between the impellor and housing, as in the original design, is the only option and seals that will do this are readily available from several sources.

Drawing at left shows the seal used to repair one of these pumps. (One of the Triumph housings to hand had previously been fitted with a similar seal.)

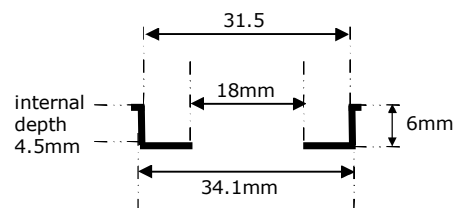
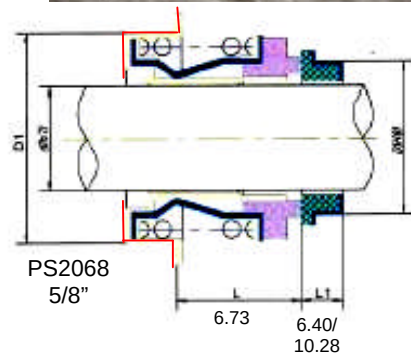
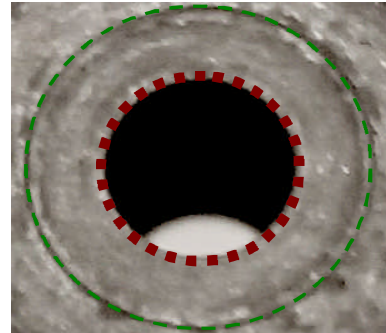
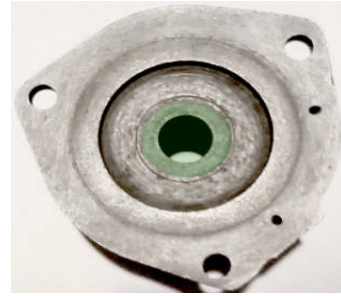
The seal shown is a 5/8" seal but will do service with the 16mm shaft. The rotating portion of the seal is pressed into the impellor – and it's a very tight fit. The housing needs machining to take a cup to hold the stationary (green portion in drawing).

For the PS2068 type seal, also known as "T68", the compressed rotary length is close to that of the original seal. The stationary supplied was only 4.4mm thick which sits 0.1mm below the top of the cup as drawn below. The cup rim also sits slightly proud of the housing.

The calculation set out on the next page is for a seal as supplied and the cup drawn below. Dimensions of cup will depend on the stationary provided. Note also that fitting only a stationary and cup to a pump housing will work with an original Triumph seal.

Sketch on the right shows the dimensions of a cup to hold the stationary, made from 40x6mm stainless steel flat bar. (The only truly critical dimension here is the 31.5mm (-0/+0.2mm) diameter for this stationary.) The flange shown at the upper edge is 1mm wide x 2mm deep and a recess of required depth is machined in the housing (see next page). The 34.1mm outside diameter of the cup is to provide a mild interference fit in a 34.0mm hole cut through the housing, which can be as thin as c3mm/1/8" here.

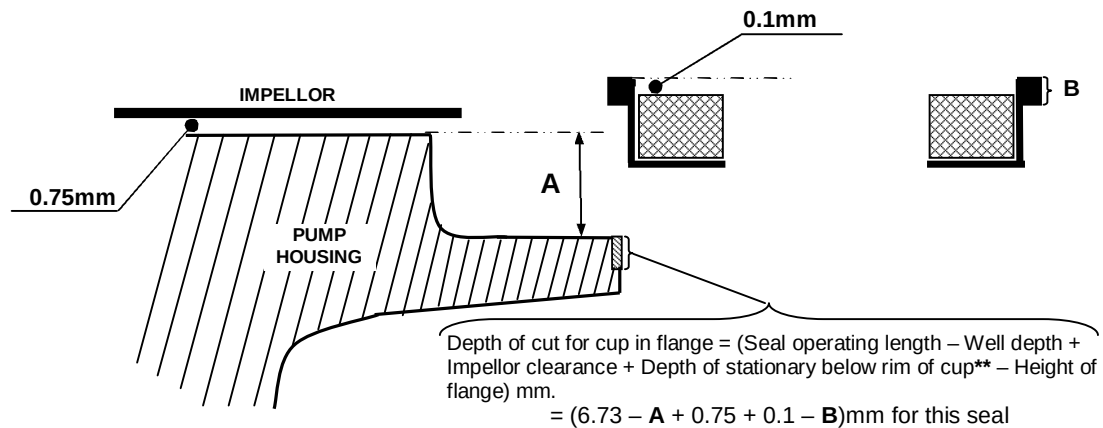
Forces on the stationary are all working in our favour; Both the water pressure in a hot engine and the spring in the rotating part of the seal act to press the stationary toward the housing. Provided that the system is not subjected to a vacuum then the seal will perform well. Note that a vacuum applied to the system with the original seal would also affect performance.



THE SEAL (continued)

The sketch below provides a check on dimensions for a stationary cup made as set out on previous page. The value "6.73" (mm) is taken from the drawing of the supplied seal. Aim for a value in the range 6.7 – 6.8mm. Depth required for one of these pumps with dimension **A** = 6.2mm and a 2mm deep flange on the stationary cup (**B**) is 1.68mm (say 1.7mm)

This calculation is a useful check for any pump. The value of 6.2mm for dimension **A** may vary between pumps but is consistent in the few samples to hand. The value of "6.73mm" is the specified operating length for the seal used here. This value can differ between brands of seal. (Another supplier offers a "T68" seal with an operating length of 3.8mm (according to the data provided). Such a seal would require the stationary to sit several mm above the pump housing, requiring a modified cup.)



*** This value will be negative if stationary sits above rim of cup.*

The rotary part of the seal is a tight fit in the impellor and will need to be fitted in a press. Sealant was applied to the rim of the seal base before fitting. The seal requires a 36mm bore on the impellor which is the diameter of the original seal. Check this measurement – if more than 36.4mm then this seal will be unsuitable for use with that impellor.

On the last page of this document is the spec sheet for the type of seal used here, with the relevant dimensions highlighted. The listing for the standard stationary with this seal lists one 10.28mm thick. As noted, the stationary supplied is only 4.4mm thick (measured) so presumably there are options with the various components allowing a certain amount of "mixing and matching" of the seal components.

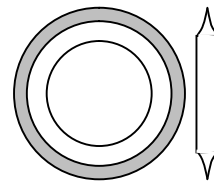
The seal was supplied by Omni Engineering Ltd of Christchurch who I am told can do this work for you - at a price. But sometimes, as in this case, it is very satisfying to do the work yourself - if you have access to the necessary equipment.

The dimensions provided in sketch above, are those for the seal supplied. Different seals may require some or all dimensions to be changed.

THE OTHER "SEAL/SPINNER (60313):

This sits on the shaft, against the circlip, to fling any water that may enter outwards toward the housing and then to waste via the drainage hole. It is hard to find/no longer available. The old seal can generally be re-used but one could be made from any material that will withstand water and cooling system temperature. High temperature plastic, a stainless steel disc with a swaged hub or even a reinforced rubber disc could be used to do the job. Whatever material is used, it must be a tight fit on, and must seal against, the shaft. (See also note on first page.)

Sketch of the 60313 seal.
O.D. is 1" for a good item
I.D. is 16mm nominal –
must be a tight fit on shaft.

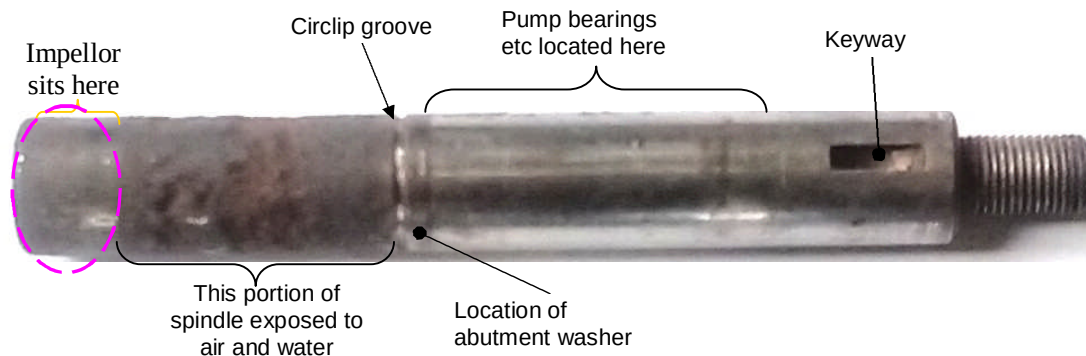


THE SPINDLE:

The annotated photograph below shows a spindle removed from an old pump. Some slight corrosion is evident where the impellor locates (circled). Note that the impellor end of the spindle is at cooling system pressure but the other side of the impellor is at atmospheric pressure. This provides a potential mechanism for water penetration and is the reason that soldering the end of impellor/spindle is specified. (Refer diagram at the bottom of this page.)

This spindle is not bent and the threaded portion where the pulley retaining nut sits is not "mushroomed". Despite the unsightly corrosion evident near the impellor, this spindle could be cleaned up and re-used. It would not be hard to make a new spindle if you have access to a metal-working lathe and a suitable cutter for the keyway‡; material 16mm diameter (not 5/8" which is equal to 15.875mm diameter) [stainless] steel.

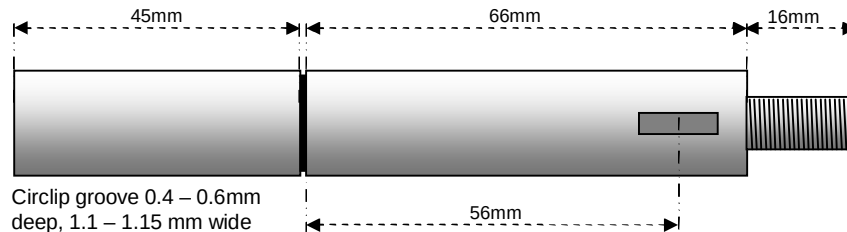
‡ For a pump using a cotter to fix the pulley, mill a flat on the shaft - use the original shaft as a pattern.



SPINDLE DIMENSIONS:- Apart from the spindle diameter, circlip groove dimensions and the keyway depth and width, none of the above dimensions are critical. The figures shown represent the average measured over three spindles. Threaded portion is 5/16" UNF for genuine Stanpart spindles but an aftermarket spindle to hand is threaded 3/8" UNF. The keyway is 4.5mm deep (full depth of cutter) and 3.2mm (1/8") wide. Requires a 1/8" x 5/8" x 1/4" (width x diameter x height) Woodruff key. Radius impellor end of the spindle, bevel pulley end.

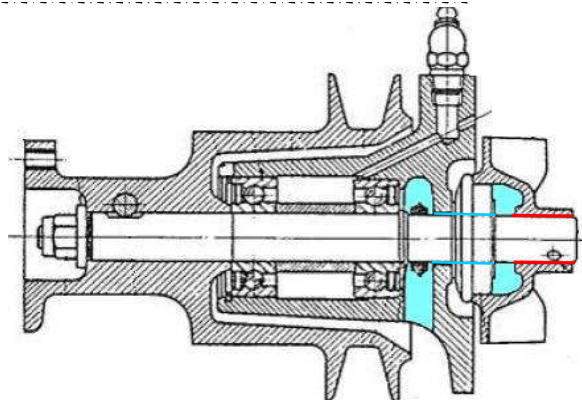
(Spindle length may be longer in early cars using a cotter pin to attach pulley. Use existing spindle as pattern.)

DRAWING NOT TO SCALE!



Cross-section diagram at right shows those portions of these pumps, in the vicinity of the mechanical seal, that are at atmospheric pressure (blue fill). If the impellor is not a perfect seal on the spindle then pressurised (hot) water from the cooling system can flow between these parts (red lines)

This diagram is taken from a factory Vanguard Phase I service manual. Here the pulley is locked in place with a cotter pin and the impellor is pinned to the spindle. In later pumps, a Woodruff key replaces the cotter pin and most impellers are a press fit on the spindle. (Refer exploded diagram "Fig. 10" on page 2 and later view of Mayflower water pump with Woodruff key and pinned impellor.)



The factory recommendation for sealing between the spindle and impellor is to use a low melting point solder. Solders with a melting point of 138 °C are available, though maybe not readily so. Given that the actual temperature required during soldering may be tens of degrees above the melting point, to promote solder flow, then solder with this melting point would be ideal. The seal used here is rated to 200°C but I have no idea what the maximum rated temperature of the original seal is.

Alternatively, a smear of sealant similar to Hylomar Blue or Loctite 567 (these sealants have maximum operating temperatures of 250°C) on the spindle may be equally effective, avoiding problems with heat from soldering. This may be a better bet when re-assembling a pump when re-using the original spindle as corrosion may prevent complete wetting, and hence sealing, of the surfaces with solder.

THE HOUSING:

Treat with care when working with it. The part where the seal sits is relatively fragile and can be damaged if handled roughly during dismantling.

Forming the 34mm diameter hole for the seal is readily achieved by means of a hole saw of about 31mm diameter held in the tailstock of a lathe then finish with light cuts with a boring tool. Holding the housing accurately in the lathe is achieved by gripping the internal bearing surface with the chuck jaws. Check that it is running true by measuring runout on the existing hole for the spindle. Some housings have the nose face machined flat and square which helps with alignment.

RE-ASSEMBLING THE PUMP:

Basically, re-assembly is a reverse of dismantling

Points to note are:

Smear a thin film of sealant on the outer part of the stationary cup before pressing into place (ditto for the rotary element's cup before fitting to the impellor).

Fit seal/spinner, circlip, spacer (if required) and abutment washer to the spindle followed by the ball bearings and distance piece. Press this assembly into place in the housing. This should be a firm but not a tight fit. Refit the bearing retaining snap-ring/circlip which will prevent axial movement of the bearings in the housing. Fit the pulley and draw everything up tight with a nut and washer on the spindle.

Fit the stationary to its cup. This will simply push in – a bit of water-based lubricant on the rubber may help here. Take care not to mark the surface of the stationary. Use Nitrile, or similar, gloves. Fit the seal to the impellor and smear a light film of sealant around the end of the spindle. (Unless you intend using solder to provide a seal.) Press the impellor onto the spindle until the clearance between the impellor and housing is correct – 0.75mm/0.030".

IMPORTANT – when fitting the impellor, force must be taken on the end of the spindle and **NOT** on the pulley, otherwise the bearings may be damaged.

That's it. Job done!

Was it worth it? Costs per pump are set out in table below. I have purchased items from suppliers I have dealt with in the past and who have supplied good quality product. Some savings could be made with, for example, bearings. One supplier lists these as \$6.50 +gst, a lot less than the \$14.88 +gst that I spent.

This does not include any estimate for my time, for tooling costs nor for components (1.6mm spacer) made from scrap to hand.

It was an interesting exercise and I'm happy with the result. So "yes", I think it was worth it!

ITEM	COST
Seal	\$37.80
Stationary	
Spindle	\$4.24
Bearing x 2	\$29.76
Freight	\$5.37
316 stainless steel 40x6mm bar (per cup)	\$1.67
Stainless steel circlip	\$2.02
g.s.t.	\$12.12
TOTAL	\$92.99

PHOTO GALLERY

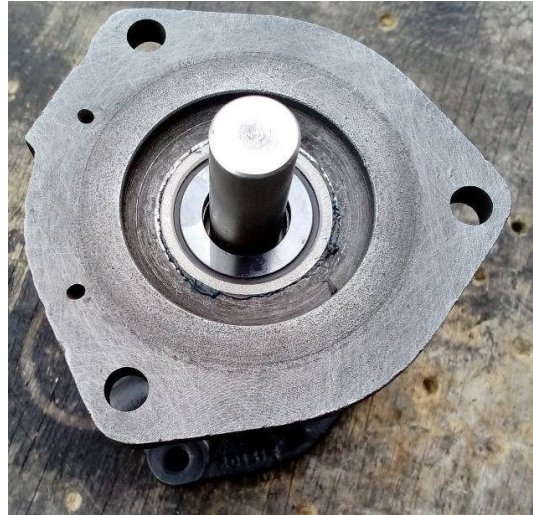


At left, photographs of finished stationary cups.

Top – finished turned cup of 316 stainless steel.

Bottom – cup with stationary fitted in place. Normally the stationary would be fitted to the cup (it's simply pressed in) after the cup has been fitted to the pump housing.

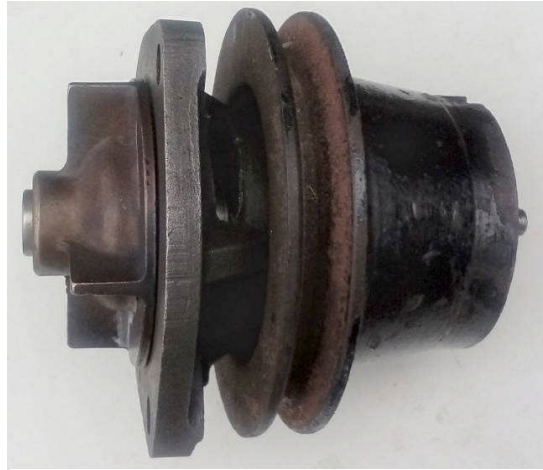
At right, a photograph of a stationary & cup fitted into a 201316 housing. (Note sealant placed around flange of cup.)



Photograph above shows a home-made spindle with a new stainless steel circlip. Spindle is made from 16mm diameter 304 grade stainless steel. (Material cost of shaft was about \$6, including freight cost, plus some time – tools were to hand. Canley Classics advertise spindles for £36+.)

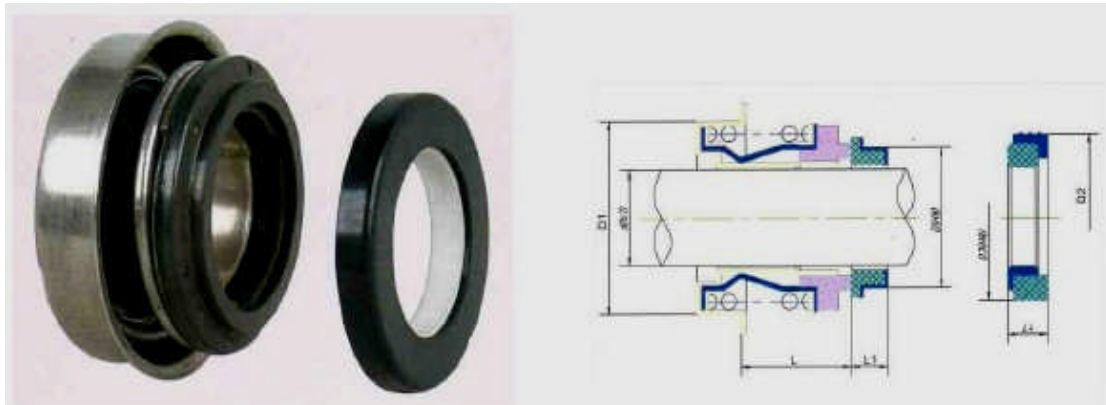


Seal fitted to an impellor ready for assembly.



Finished pump ready to be re-fitted.
This one for a 1600 cc Vitesse.

SEAL SUPPLIED FOR THIS WORK:



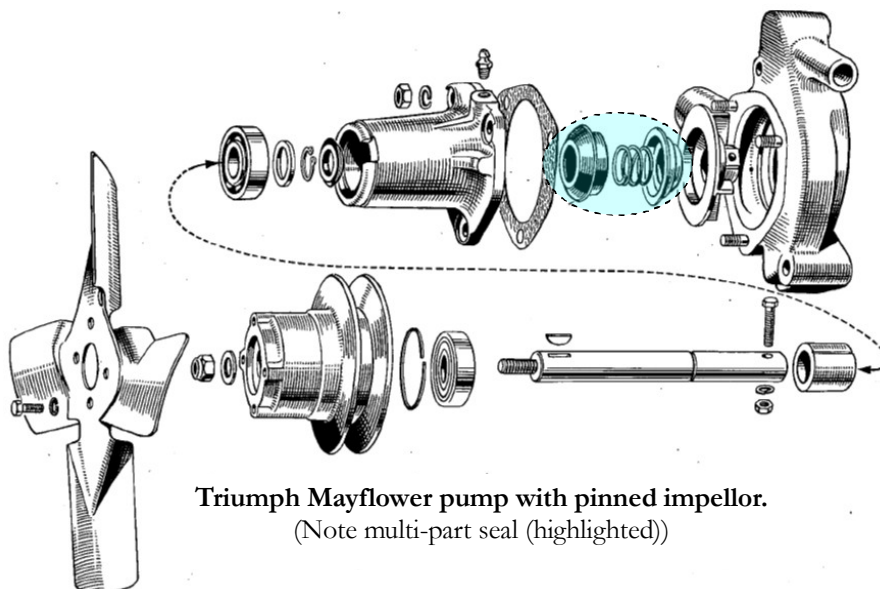
MATERIALS

- Stationary ring: alumina ceramic, silicon carbide
- Rotary ring: carbon, silicon carbide, tungsten carbide
- Spring and Punched parts: 304, 316

OPERATING LIMITS

- Pressure up to 4 Bar,
- Temperature = -40°C to +200°C
- Speed = up to 9000 rpm

Size-D	D1	D2	L	L1/L4
0.500"	28.58	25.40	5.16	6.4
0.500"	30.08	25.40	5.16	8.00
0.625"	36.48	31.75	6.73	10.28
0.625"	36.48	38.10	6.73	6.40
0.750"	40.02	34.93	6.0	10.28
0.750"	40.02	35.00	6.0	5.02
0.750"	40.02	38.10	6.0	10.28
1.125"	52.00	48.00	9.48	8.0



Triumph Mayflower pump with pinned impeller.
(Note multi-part seal (highlighted))